CLAIMS

What is claimed is:

1. A method for visualizing information comprising the steps of:

    a) receiving information having plurality of items;

    b) generating a graph of the items by arranging the items on a
        spherical surface to specify an initial position of each item;

    c) constructing a frequency matrix for defining a stiffness measure
        of a spring attached to each pair of items;

    d) relaxing the graph; wherein after relaxation the graph converges
        to a state of local minimal energy; wherein the distance
        between a pair of items represents the frequency of the item
        set in the transaction data; and

    e) employing a directed edge to represent the association
        confidence levels and association directions between the
        items in the transaction data.

2. The method of claim 1 further comprising the steps of:

    f) generating a confidence matrix for defining the confidence level
        of each association.

3. The method of claim 2 further comprising the steps of:

    g) receiving a user-defined minimum confidence level;

    h) displaying items having an association with a confidence level
        that is in a predetermined relationship with the user-defined
        minimum confidence level.

4.   The method of claim 1 wherein the step of receiving a plurality of

items comprises the steps of:

a_1) receiving Internet transaction data; wherein the transaction

data is described as follows

5   Transactions {T1, T2, ..., Tn}

Products {P1,....Pm}

Transaction Ti = {P1, ... , Pmi}   i = [1..n]; and

a_2) extracting items from the Internet transaction data.

10   5.   The method of Claim 1 wherein the information includes a

plurality of transactions, where each transaction includes one or

more items; and wherein the step of generating a graph of the items

by arranging the items on a spherical surface to specify an initial

position of each item includes the step of

15   b_1) organizing the items based on how frequently the items

appear in transactions; and

b_2) specifying the initial position of each item in one of a random

fashion and a predetermined fashion.

20   6.   The method of Claim 5 wherein the step of specifying the initial

position of each item in one of a random fashion and a

predetermined fashion includes the step of

distributing the items equally on a spherical surface; wherein

tightness is a sum of all supports from a current item to directly

25   adjacent items; and wherein more tightly related items are disposed

in the center of the sphere and the less tightly related items are

evenly distributed around the center.

7. The method of Claim 6 wherein the step of distributing the items equally on a spherical surface includes

distributing the items equally on a spherical surface by employing a

5   Poisson Disc Sampling.

8. The method of claim 1 wherein the frequency matrix includes a

plurality of elements, wherein each element includes the frequency

of occurrence of the association in all transactions after

10   normalization.

9. The method of claim 1 further comprising the step of:

transforming stiffness of the spring to a distance in a three-dimensional sphere;

wherein the distance between each pair of items represents the support therebetween.

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10. The method of claim 1 wherein employing a directed edge to

represent the direction of an association between two items further

includes the step of:

employing color of the edge to indicate confidence level.

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11. A system for use in visualizing information comprising:

a) a source of transaction data having items; and

b) a directed association mechanism coupled to the source of transaction data

for receiving transaction data, mapping items and relationships between items to

25   vertices, edges, and positions on a visual spherical surface, and for generating and

displaying a self-organized graph, wherein the distance between each pair of items

represents support, a directed edge represents the direction of the association, and the color of the edge is used to represent the confidence level.

12.   The system of claim 11 wherein the directed association

5   mechanism further comprises:

an initialization component for receiving items and arranging the items into an initial position on a spherical surface to generate a graph;

a relaxation component for constructing a frequency matrix that defines a stiffness measure of a spring attached to each pair of items and for relaxing the graph;

10   wherein after relaxation the graph converges to a state of local minimal energy; and

a direction component for determining edge direction and edge color; wherein the support is the frequency of the item set in the transaction data.

13.   The system of claim 12 wherein the relaxation component encapsulates a mass-

15   spring engine for relaxing the graph and enabling the graph to converge to a state of local minimal energy.

14.   The system of claim 12 wherein the direction component generates a confidence matrix for defining the direction and confidence level of the association rules.

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15.   The system of claim 11 wherein the source of transaction data is an electronic commerce web site, the items are products for sale, and the transaction data is transaction data from an electronic commerce application; and

wherein the system is utilized to visually associate product affinities and

25   relationships therebetween.

16.   The system of claim 11 wherein the system is utilized in a market basket analysis application.

17.   The system of claim 11 wherein the system is utilized in a telecommunications

5   fraud application.

18.   The system of claim 11 wherein the system is utilized in a network traffic analysis application.

10   19.   The system of claim 11 wherein the system is utilized in a text mining application.

20.   The system of claim 11 wherein the system is utilized in a user profiling application.

15